MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2320
Gaithersburg, Maryland 20899-2320

SRM Number: 3133
MSDS Number: 3133
SRM Name: Mercury Standard Solution

Date of Issue: 03 November 2005

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Description: This Standard Reference Material (SRM) 3133 is intended for use as primary calibration standard for the quantitative determination of mercury. One unit of SRM 3133 consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a known mass fraction of mercury. The solution contains nitric acid at a volume fraction of approximately 10 %.

Substance: **Mercury Standard Solution (Mercury in 10 % Nitric Acid)**

Other Designations: **Mercury** (quicksilver; hydrargyrum) in **Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; nitryl hydroxide); **Mercuric Nitrate**[(a)] (mercury nitrate; mercury [II] nitrate; mercury dinitrate; mercury pernitrate)

[(a)] The addition of mercury to nitric acid forms mercuric nitrate along with other intermediate chemical reactions.

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Number	EC Number (EINECS)	Nominal Concentration (%)
Nitric acid	7697-37-2	231-714-2	10 (by volume)
Mercuric Nitrate	10045-94-0	233-152-3	< 1.6 (by mass)
Mercury	7439-97-6	231-106-7	1 (by mass)

EC Classification (assigned):

Mercury, Mercuric Nitrate
T, N

Nitric Acid Solution: 5% ≤ C < 20 % (C = concentration)
C

Danger Hazard Symbol:

Mercuric Nitrate Concentration Limits: 0.5 % ≤ C < 2 %
T

Mercury
T, N

Nitric Acid Solution: 5% ≤ C < 20 %
C

EC Risk: **Mercuric Nitrate Concentration Limits: 0.5 % ≤ C < 2 %**
R23, R24, R25, R33

Mercury
R23, R33, R50, R53

Nitric Acid Solution: 5% ≤ C < 20 %
R34

EC Safety: **Mercury, Nitric Acid Solution**
S1, S2, S13, S23, S26, S28, S36, S45, S60, S61

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0–4): Health = 3 Fire = 0 Reactivity = 0

Major Health Hazards: Allergic reactions. Respiratory tract, mucous membrane, skin, and eye burns.

Potential Health Effects

Inhalation: **Nitric Acid:** Corrosive. Effects should be less severe than from exposure to higher concentrations of nitric acid where exposure may cause respiratory irritation with coughing, choking, and burns of the mucous membranes.

Skin Contact: **Nitric Acid:** Corrosive. Effects should be less severe than from exposure to higher concentrations of nitric acid where exposure may cause pain and severe burns to the skin. Dilute solutions of nitric acid may cause mild irritation and harden the epidermis.

Mercury, Mercuric Nitrate: Solutions of mercuric acid may be corrosive and may cause redness, pain, and skin burns. Small amounts of mercury may be absorbed through intact skin.

Eye Contact: **Nitric Acid:** Corrosive. Effects should be less severe than from exposure to higher concentrations of nitric acid where exposure may cause pain, lacrimation, photophobia, and severe burns to the eye.

Mercuric Nitrate: Solutions are corrosive and may cause redness, pain, and blurred vision.

Ingestion: **Mecury, Mercuric Nitrate, Nitric Acid:** Ingestion of inorganic mercury compounds may cause a burning mouth, sore throat, metallic taste, nausea, vomiting, thirst, and diarrhea. Chronic exposure of mercury is cumulative, and exposure even to small amounts can raise the body's content to toxic levels. Nitric acid is corrosive: Effects should be less severe than from exposure to higher concentrations of nitric acid where exposure may cause severe burns of the mucous membranes of the mouth, throat, and esophagus. Symptoms due to exposure of nitric acid include immediate pain, difficulty or inability to swallow or speak, marked thirst, nausea, vomiting, and diarrhea.

Listed as a Carcinogen/ Potential Carcinogen:

Yes	No	
____	X	In the National Toxicology Program (NTP) Report on Carcinogens.
____	X	In the International Agency for Research on Cancer (IARC) Monographs.
____	X	By the Occupational Safety and Health Administration (OSHA).

4. FIRST AID MEASURES

Inhalation: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing by qualified personnel. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention if necessary.

Eye Contact: Flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Get immediate medical attention.

Ingestion: If a large amount is swallowed, get immediate medical attention. Do NOT induce vomiting.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Mercury Standard Solution is a negligible fire hazard.

Extinguishing Media: Use water or any means suitable for extinguishing surrounding fire.

Fire Fighting: Move container from fire area if possible without exposure to risk. Avoid inhalation of material or combustion by-products. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point: Not available.

Method Used: Not available.

Autoignition Temperature: Not available.

Flammability Limits in Air
Upper (Volume %): Not available.
Lower (Volume %): Not available.

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Do NOT touch material. Collect the material in an appropriate container for disposal. Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of sewer and water supplies.

Disposal: See Section 13, "Disposal Considerations".

7. HANDLING AND STORAGE

Storage: Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances.

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:

Nitric Acid
OSHA: 5 mg/ m^3 (2 ppm) TWA
ACGIH (TLV): 2 ppm TWA
NIOSH: 5 mg/m^3 (2 ppm) recommended TWA (10 h)
WEL UK: 5.2 mg/m^3 (2 ppm) TWA

Mercury, All Forms except Alkyl (as Hg)
OSHA: 0.1 mg/m^3 ceiling
ACHIG (TLV): 0.025 mg/m^3 TWA (metal and inorganic compounds) (skin)
NIOSH: 0.05 mg/m^3 recommended TWA (10 h) (vapor, skin)
NIOSH: 0.1 mg/m^3 recommended ceiling (skin)

Ventilation: Use a local exhaust ventilation system. Ensure compliance with applicable exposure limits.

Eye Protection: Wear safety goggles. An eye wash station should be readily available near areas of use.

Personal Protections: Wear appropriate chemical resistant clothing and gloves to prevent skin exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component:	**Mercury Standard Solution**
Appearance and Odor:	Liquid. Irritating odor.
Density:	Not available.
Water Solubility:	Soluble.

10. STABILITY AND REACTIVITY

Stability:	X Stable ____ Unstable
	Stable at normal temperatures and pressure.
Conditions to Avoid:	Avoid contact with incompatible and combustible materials.
Incompatible Materials:	Acids. Halogens. Combustible materials. Oxidizing materials. Metals. Bases. Metal Salts. Metal Oxides. Reducing agents. Cyanides. Peroxides.
Fire/Explosion Information:	See Section 5, "Fire Fighting Measures".
Hazardous Decomposition:	Thermal decomposition may produce mercury and oxides of nitrogen.
Hazardous Polymerization:	____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: X Inhalation X Skin X Ingestion

Toxicity Data:

Nitric Acid
Human, Oral LD_{LO}: 430 mg/ kg
Rat, Inhalation LC_{50}: 260 mg/m^3 (30 min)
Rat, Skin TD_{LO}: 150 ml/kg

Mercury
Man, Oral TD_{LO}: 43 mg/kg
Man, Inhalation TC_{LO}: 44 300 $\mu g/m^3$ (8h)
Woman, Inhalation TC_{LO}: 150 $\mu g/m^3$ (46 d)
Man, Skin-continuous TD_{LO}: 129 mg/kg (5 h)
Man, Subcutaneous TD_{LO}: 714 µL/kg
Man, Intravenous TD_{LO}: 571 µL/kg

Mercuric Nitrate
Rat, Oral LD_{50}: 26 mg/kg

Reproductive, Tumorigenic, Mutagenic Data:

Nitric Acid: Nitric acid has been investigated as a reproductive effector.

Mercury: Mercury has been investigated as a reproductive, mutagenic, and tumorigenic effector.

Mercuric Nitrate: Mercuric nitrate has been investigated as a mutagenic effector. May cross the placenta.

Medical Conditions Aggravated by Exposure:

Nitric Acid: Eye, respiratory, and skin disorders. Allergies.
Mercury and Mercuric Nitrate: Kidney disorders. Nervous system disorders. Respiratory disorders. Skin disorders. Allergies.

Health Effects (Acute and Chronic):

See Section 3, "Hazards Identification".

12. ECOLOGICAL INFORMATION

Ecotoxicity: Mercury is toxic to aquatic life and the environment. The LC_{50} (96 h) value for fish is 180 µg/L.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose in accordance with federal, state, and local regulations. Dispose of in accordance with U.S. EPA 40 CFR 262, Hazardous Waste Number D009 for concentrations at or above the Regulatory Level for mercury (0.2 mg/L).

14. TRANSPORTATION INFORMATION

U.S. DOT & IATA: Nitric acid, solution; Hazard Class 8, UN2031; Packing Group II; Excepted quantity (10 mL × 5 ampoules).

15. REGULATORY INFORMATION

U.S. Regulations: CERCLA Sections 102a/103 (40 CFR 302.4): Mercuric Nitrate: 10 lbs RQ; Mercury: 1 lbs RQ. Nitric Acid: 1000 lbs RQ.

SARA Title III Section 302 (40 CFR 355.30): Nitric Acid: 1000 lbs TPQ; Mercuric Nitrate and Mercury: not regulated.

SARA Title III Section 304 (40 CFR 355.40): Nitric Acid: 1000 lbs RQ; Mercuric Nitrate and Mercury: not regulated.

SARA Title III, Section 313 (40 CFR 372.65): Mercury. Mercury compounds. Nitric Acid

OSHA Process Safety (29 CFR 1910.119): Nitric Acid: 500 lbs TQ (≥ 94.5 % by weight). Mercuric Nitrate and Mercury: not regulated.

California Proposition 65: Mercury and mercury compounds are known to the state of California to cause developmental toxicity (1990). Nitric acid is not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE:	Yes.
CHRONIC:	Yes.
FIRE:	No.
REACTIVE:	No.
SUDDEN RELEASE:	No.

CANADIAN Regulations: WHMIS Classification: Not determined.

National Inventory Status: U.S. Inventory (TSCA): Mercury, Mercuric Nitrate, and Nitric Acid are listed on inventory.

TSCA 12b Export Notification: Not listed.

EC Classification:	**Mercury, Mercuric Nitrate**	
	T	Toxic.
	N	Dangerous for the Environment.
	Nitric Acid Solution: 5% ≤ C < 20 % (C = concentration)	
	C	Corrosive
Danger/Hazard Symbol:	**Mercuric Nitrate Concentration Limits: 0.5 % ≤ C < 2 %**	
	T	Toxic
	Mercury	
	T	Toxic
	N	Dangerous for the Environment.
	Nitric Acid Solution: 5% ≤ C < 20 %	
	C	Corrosive
EC Risk Phrases:	**Mercuric Nitrate: 0.5 % ≤ C < 2 % (C = concentration)**	
	R23	Toxic by inhalation
	R24	Toxic in contact with skin.
	R25	Toxic if swallowed.
	R33	Danger of cumulative effects.
EC Risk Phrases:	**Mercury**	
	R23	Toxic by inhalation
	R33	Danger of cumulative effects.
	R50	Very toxic to aquatic organisms.
	R53	May cause long-term adverse effects in the aquatic environment.
EC Risk Phrases:	**Nitric Acid Solution: 5% ≤ C < 20 %**	
	R34	Causes burns.
EC Safety Phrases:	**Mercuric Nitrate, Mercury, Nitric Acid**	
	S1/2	Keep locked-up and out of the reach of children.
	S13	Keep away from food, drink and animal feeding stuffs.
	S23	Do NOT breathe gas, fumes, vapor, or spray.
	S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
	S28	After contact with skin, wash immediately with plenty of water.
	S36	Wear suitable protective clothing.
	S45	In case of accident or if you feel unwell, seek medical advice immediately.
	S60	This material and its container must be disposed of as hazardous waste.
	S61	Avoid release to the environment.

16. OTHER INFORMATION

Sources: MDL Information Systems, Inc., MSDS *Mercury* 16 June 2005.
MDL Information Systems, Inc. MSDS *Mercuric Nitrate* 16 June 2005.
MDL Information Systems, Inc. MSDS *Nitric Acid Solutions* 16 June 2005.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.